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Agriculture Information Bulletin No. 224

QUESTIONS AND ANSWERS

ON AGRICULTURAL RESEARCH

In the U.S. Department
of Agriculture and the
State Agricultural
Experiment Stations

U.S. DEPARTMENT OF AGRICULTURE
Agricultural Research Service

This publication answers typical questions about the science and technology of agriculture, particularly those that concern publicly financed research activity of the U.S. Department of Agriculture and the State agricultural experiment stations. Many agencies within the Department have collaborated to provide these answers. We hope these answers will give visitors to the USDA a better understanding of the complex effort and cooperation necessary for developing a strong agricultural economy.

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Questions and Answers

on AGRICULTURAL RESEARCH in the U.S. Department of Agriculture and the State Agricultural Experiment Stations

AGRICULTURAL RESEARCH

Agricultural research in the United States has had a brief but successful history. It represents a great, cooperative undertaking in which the Federal, State, and county governments, private industry, farmers and farmer organizations, and private foundations are associated for a common purpose—to unearth new knowledge of benefit to agriculture and mankind. A close kinship exists between science and education. Contributions made by men of science from all nations have benefited agriculture in the United States. This cooperative enterprise has been publicly financed to a considerable extent. Out of it have come many advances, such as mechanized agriculture; modern food processing; the discovery of vitamins; modern animal nutrition; numerous life-saving antibiotics; and continuing statistical and economic analyses of agricultural production, farm incomes and costs, and prices and stocks of products, to mention but a few.

Agricultural research, beginning in an organized way with the establishment of the U.S. Department of Agriculture (USDA) in 1862, has developed through the years until today the State agricultural experiment stations and the USDA together constitute a large cooperative agricultural research organization with a program designed to deal with problems of county, State, regional, national, and international significance.

Foreign visitors to the USDA ask many questions about the organization of agricultural research in the United States. So that visitors may have the information in written form for reference purposes, some of these questions and answers to them are presented in the following pages.

In its organizational sense, the term “agricultural research” means research carried on by the

USDA and the State agricultural experiment stations. This publication, therefore, describes only that research which they conduct. Visitors should remember, however, that information of interest to agricultural research workers is available from many other public and private organizations.

The need for such widespread activity in agricultural research is inherent to the geography of the United States, and of Puerto Rico and the Virgin Islands. In this area, approximately 7,000 soil series are recognized on more than 130 identified land-resource areas. The number of soils is increasing with new surveys and classifications. The United States has five distinct climatic belts between the Atlantic and Pacific Oceans; and, from north to south, the climate ranges from arctic to tropical. Tremendous differences consequently exist in native vegetation and in the diversity of agricultural crops. Changes in market structure and techniques and in consumer demands also bring numerous production and distribution problems. For example, the vastness of the marketing system requires that, on an average, food be picked up and set down 20 times between farm and consumer. How this is done has much to do with the price we pay for food and fiber. Research helps to keep this handling as efficient as possible and the product in top-quality condition.

The many physical differences and consequently wide variations in agriculture are one basis for the dual structure of our publicly financed research. The other is the political organization of the United States. Through wide dispersal of Federal and State research establishments, science is brought close to farmers (see map, pp. 18 and 19). In each area, needs of farmers, marketing agencies,

and consumers are thus readily determined. This dual structure has been particularly valuable in meeting the diversified problems that arise because of the great variations in farming patterns in the United States. For example, corn and hog production is centered in the Middle West; wheat production is concentrated in the Great Plains States and the Pacific Northwest; cotton is grown in the Southern and Southwestern States; citrus fruits are produced mostly in California, Texas, and Florida; and, although beef cattle production is centered in the Great Plains and cattle feeding in the Corn Belt States, both are expanding in the South. Dairy production is centered near large cities and in the Lake States, while specialized areas in the Southeastern and Southern States account for most of the production of chickens for meat.

Differences in the growing and consuming areas of the Nation also present a problem in marketing. For example, pears grown in Washington must be protected as they are shipped over the snow-chilled Rocky Mountains; Florida corn must be kept just above freezing as it is shipped in February to the cold of New England; and Maine potatoes must be kept warm as they are shipped in winter to the Midwest. Competition between production areas, long-distance move-

ments from producing farms to consuming centers, and consolidation and integration of processing and distribution firms into larger units—all these result in economic problems of production and marketing that are national or regional in scope.

Such broad diversity of agriculture explains the need for the cooperative research effort between the USDA and the States. Every field of cooperative agricultural research has made tremendous contributions to the technology of American farming. Foreign countries, too, have aided this research. The United States has drawn heavily on introduced plants and animals from foreign lands to supply valuable germ plasm for establishing and improving the crops and animals of this country.

Through exchange of information, results of agricultural research here and in other countries are made mutually available. Such information thus finds its way to the farthest corners of the world. This information exchange is currently being fostered through the technical consultation, assistance, and training programs conducted cooperatively by the USDA and the AID (the Agency for International Development of the Department of State, formerly ICA), as well as other international and public and private agencies.

QUESTIONS AND ANSWERS ON AGRICULTURAL RESEARCH

What is the historical development of Federal-State cooperation (land-grant colleges and State universities, State experiment stations, cooperative Extension Service, and the USDA)?

In 1862, the Congress of the United States created what is now the U.S. Department of Agriculture (USDA). This Federal agency was directed to acquire and diffuse useful information on subjects connected with agriculture in the most general and comprehensive sense of the word. That same year the Congress also passed the Land-Grant College Act, donating public lands to the several States and Territories in order to provide colleges for the benefit of agriculture and the mechanic arts.

In 1887, the Congress passed the Hatch Experiment Station Act, which provided for the estab-

lishment of an agricultural experiment station in connection with the land-grant institutions of each State and Territory. This foundation stone for the close cooperation and working relationship between State and Federal agricultural research resulted in the ultimate establishment of experiment stations in each State and in Puerto Rico and the Virgin Islands. The State stations are responsible only to their State or Commonwealth authorities, yet they are closely associated with the USDA.

In 1914, the Congress passed the Smith-Lever Act, which established the cooperative Extension Service as a means of carrying or extending to American farms and farmers information and findings from the land-grant colleges and universities and the Federal-State agricultural experiment stations.

The Research and Marketing Act of 1946 brought together and expanded a new field of re-

search. This research, called marketing research, is now conducted by personnel of the Agricultural Marketing Service headquartered in Washington, D.C., and at field stations throughout the Nation. Much of this research is done in close cooperation with State agencies. Marketing research is also conducted by the Economic Research Service and the Statistical Research Service.

This publicly sponsored establishment of cooperation, linked closely through State and Federal legislation and even more closely through the kinship of related disciplines, has contributed immensely to the technological progress of farming and to the welfare of mankind.

What are the basic administrative problems of Federal-State agricultural research establishments in the United States? How do farmers' problems come to the attention of research personnel? How are they handled? How are agricultural research results made known?

Meeting the needs of the extensive research required in the Federal- and State-financed establishments raises some problems, such as: How to meet the most urgent needs in the various geographic areas in the different political divisions of the country; how to group the many different types of research undertakings to get results without waste of effort and duplications; how to establish close liaison and cooperative working relationships among the various institutions and individuals engaged in agricultural research; how to finance the required research and obtain competent and adequately trained scientific personnel; and how to provide wide dissemination of the scientific information needed by the scientists engaged in research and of the results growing out of the research beneficial to farmers and the general public.

To understand how these problems are handled, it should be pointed out that State experiment stations are primarily concerned with the solution of problems of importance to the welfare of farmers and other people within the States. Solutions of problems that are national in scope or problems that cannot be solved by the individual States are sought by the Federal Government, often working in close cooperation with individual States or the

experiment stations of several States. Regional problems usually are the subject of cooperation between the stations of the region and the USDA.

The demand for adequately trained scientific personnel is being met by the land-grant colleges and other colleges and universities. Although the organization of the land-grant colleges varies considerably, each includes three major services to agriculture. One of these is classroom education, which provides both undergraduate and graduate studies in science for preparing personnel to engage in farming, research, and other technical occupations. The second is research. Although this is done in various subject-matter departments, such as soils, agronomy, and pathology, the overall responsibility for agricultural research in each station is centered in a single administrator, the State experiment station director. The third basic service is cooperative extension work.

Most stations have advisory committees and boards that bring problems to the station directors, as do many farm groups and individual farmers. Under the regional program, there are technical advisory committees made up of specialists from participating State experiment stations and agencies of the USDA. On a national basis, there are a number of research and marketing advisory committees (see p. 9) and a number of committees developed through the Association of Land-Grant Colleges and Universities. Farm organizations and numerous farmer production groups are also close cooperators with the land-grant institutions.

Results from agricultural research are made known in a number of ways. The institutions carrying on research issue both technical and popular bulletins and reports. Public agency publications and those from the technical press constitute the firm core of basic information. Periodicals and other timely releases on food costs; farmers' incomes and costs; land prices; and the situation relative to supply, demand, prices, consumption, and outlook are issued regularly by the Department.

Dissemination of new results is far more widespread through such mass media as farm magazines, newspapers, radio, and television; through the schools and colleges; and through the beyond-the-classroom educational programs that the cooperative Extension Service carries on. The close association between research and extension work, both in the USDA and at the land-grant colleges

and universities, has played an important part in motivating farm people to adopt new farm practices developed through agricultural research.

How is agricultural research financed in the United States?

Federal research is financed by funds appropriated annually by the Congress of the United States. The Hatch Experiment Station Act of 1887 authorized an annual Federal grant of funds for the partial support of the State stations. Through the years, the Adams, Purnell, Bankhead-Jones, Research and Marketing Acts, and certain other supplementary acts, have successively provided funds for increasing the scope of agricultural research at both the State and Federal levels to meet the growing needs of the American farmers in a rapidly expanding economy.

The Research and Marketing Act of 1946 firmly established regional research as an improved technique for attaining cooperation among State experiment stations. In addition, it provided increased support to marketing research at the Federal level and through grants to States.

In 1955, the Hatch Act and supplementary acts were consolidated into Public Law 352, which now serves as the authority for all Federal-grant payments to experiment stations.

The State legislatures, also, have encouraged and supported research by consistently appropriating funds for the solution of agricultural problems within their respective States. The individual State stations also receive financial grants from many private institutions for work in agricultural research.

Federal appropriations for agricultural research during the fiscal year 1963 total approximately \$169 million, of which \$131 million is available for direct research by USDA agencies and \$38 million for payments to State agricultural experiment stations. The States provide approximately \$142 million and are contributing about \$3.70 for each \$1 paid by the Federal Government. These Federal and State appropriations total \$311 million in public funds currently being spent on agricultural research. The amount of private research in this area is estimated at \$380 million.

In some cases, projects in which the USDA is engaged are financed in part by allotments of funds from other Federal agencies or by funds made available by private cooperators. Most re-

search divisions cooperate with organizations of producers in their respective fields. In only a few cases does the cooperator actually turn over money to the USDA; usually the cooperator and the USDA use their respective funds in conducting a program under a joint memorandum of understanding. Contracts with private agencies or institutions are entered into for research for which such contractors have special competence. Specifications pertaining to economy and time required must also be met for each contract.

Extension work in the individual States is financed cooperatively by Federal, State, and county governments; however, the greater part of the financing is provided by the county and State governments.

How many Federal and State agricultural experiment stations are there in the United States?

The State experiment stations are responsible for scientific operations and research at more than 500 centers, which include the main stations and outlying laboratories and farms. The USDA carries on research at about 225 field locations in the United States. This number includes the Federal field stations and laboratories and the State experiment stations at which the USDA undertakes cooperative work. These locations do not include private agencies that conduct research under contract with the USDA.

How many scientific people are employed in research by the USDA? By the States? By private organizations?

The USDA has approximately 4,900 full-time professional scientists engaged in research. The States have about 9,600 scientific personnel, some of whom are engaged part time in research and part time in teaching and extension work at the land-grant colleges and universities. The USDA and the States also employ many other persons in work related to research, such as subprofessional and supporting administrative personnel.

A large number of persons are also engaged in private agricultural research. These include scientists employed by farmer groups, industry, and commercial interests, and those supported by

foundations organized on a nonprofit basis to conduct or aid agricultural research.

How is the USDA organized?

The Secretary of Agriculture is responsible for the administration of the numerous functions and authorities assigned to the USDA by law, and for advising the President of the United States on Federal policy and programs affecting agriculture. He is directly assisted by the Under Secretary.

The USDA is organized into various service and administrative agencies, which are divided into major groups. Each group is headed by an Assistant Secretary or other designated official who is responsible for the interpretation and execution of agricultural policies pertaining to his group. The agencies of the USDA and their group heads are:

Agricultural Economics, Director: Economic Research Service and Statistical Reporting Service.

International Affairs, Assistant Secretary: Foreign Agricultural Service.

Marketing and Stabilization, Assistant Secretary: Agricultural Marketing Service, Commodity Credit Corporation, Agricultural Stabilization and Conservation Service, Commodity Exchange Authority, Federal Crop Insurance Corporation, and Federal Extension Service.

Rural Development and Conservation, Assistant Secretary: Office of Rural Areas Development, Farmer Cooperative Service, Farmers Home Administration, Forest Service, Rural Electrification Administration, and Soil Conservation Service.

The Agricultural Research Service and the Cooperative State Experiment Station Service report to the Secretary.

Attached directly to the Secretary's Office are the **Office of the General Counsel**, headed by the General Counsel; the **Office of the Inspector General**, headed by the Inspector General; and the **Departmental Administration**, headed by the Administrative Assistant Secretary. The Departmental Administration consists of the following: Office of Budget and Finance, Office of Hearing Examiners, Office of Information, Office of Management Appraisal and Systems Development, National Agricultural Library, Office of Personnel, Office of Plant and Operations, and Office of Management Services.

A chart of the USDA organization is presented in figure 1, page 31.

How is agricultural research organized in the USDA and in the States?

The agencies of the USDA engaged in research are the Agricultural Research Service, Agricultural Marketing Service, Cooperative State Experiment Station Service, Economic Research Service, Farmer Cooperative Service, Forest Service, Soil Conservation Service, and Statistical Reporting Service. Some other agencies conduct research in a lesser degree. These eight principal research agencies conduct comprehensive research in farm management, soil and water conservation and management, crop and livestock production, entomology, plant and animal diseases, forestry, agricultural engineering, agricultural economics, processing and utilization of agricultural products, improving and maintaining market quality and transportation facilities, cooperative organizations, and nutrition and consumer use of food and fiber. Although research is conducted in several agencies, overall coordinating responsibility is vested in the Office of the Administrator, Agricultural Research Service.

The research coordination in the USDA is diagramed in figure 2 (p. 32) and the organization of ARS in figure 3 (p. 33).

In the fields listed, the USDA cooperates closely with the State experiment stations, and one of its responsibilities is to administer the Federal-grant funds made available to the States by the Congress. In marketing and economic research and statistical reporting, the USDA also maintains cooperation with business firms, associations, marketing agencies, and State departments of agriculture. The USDA conducts about 85 percent of the Nation's research in forest production and marketing. Forestry research, in addition to being carried on at a national laboratory and at many decentralized research centers and experimental forests and ranges, also involves cooperation with various private agencies and State schools of forestry. More detailed information concerning the USDA agencies that conduct major research is given later in this publication.

The agricultural experiment stations in the States conduct research in varying degrees of emphasis in the physical, biological, chemical, engineering, economic, and other sciences. Each sta-

tion is attached to a land-grant college or State university and has a director who conducts and administers the agricultural research program within his State and aids in the leadership of regional programs. Research projects in the USDA and in the State experiment stations are coordinated through central project offices in the Cooperative State Experiment Station Service (CSESS) and in the Office of the Administrator of ARS.

What is the relationship between the USDA and the State agricultural experiment stations? Do State stations have a role in the programs of the USDA regional laboratories? Of other USDA field stations?

The USDA works in close cooperation with the State agricultural experiment stations. These stations are responsible to and maintain close contact with the people of their respective States. They are in a position at all times to recognize and study the needs of agricultural producers, marketing agencies, and consumers.

Frequently, the USDA and a State agricultural experiment station are both interested in solving a particular problem. The USDA is usually concerned because of broad regional or national interests; the State station is interested because of needs within the State. In such cases, representatives of the two agencies meet and decide what part of the total research job each will undertake. On the basis of these discussions, a formal document is prepared and signed by both parties. Several agencies of the USDA and any number of State agricultural experiment stations may join in a single cooperative undertaking to solve a problem of such scope that it extends over a considerable part of the country or into more than one subject-matter field of agricultural science.

The hybrid-corn-breeding program is an example of how the USDA and the State stations work together. The earliest work done on hybrid corn was in 1917 at one of the State experiment stations. In 1925, corn breeders in 12 States and in the USDA decided to combine their efforts so that each State could benefit from the work done in other States. This program has made possible the fullest use of all information on hybrid corn.

The phenomenal spread of hybrid corn in the United States is largely a result of the cooperative research program.

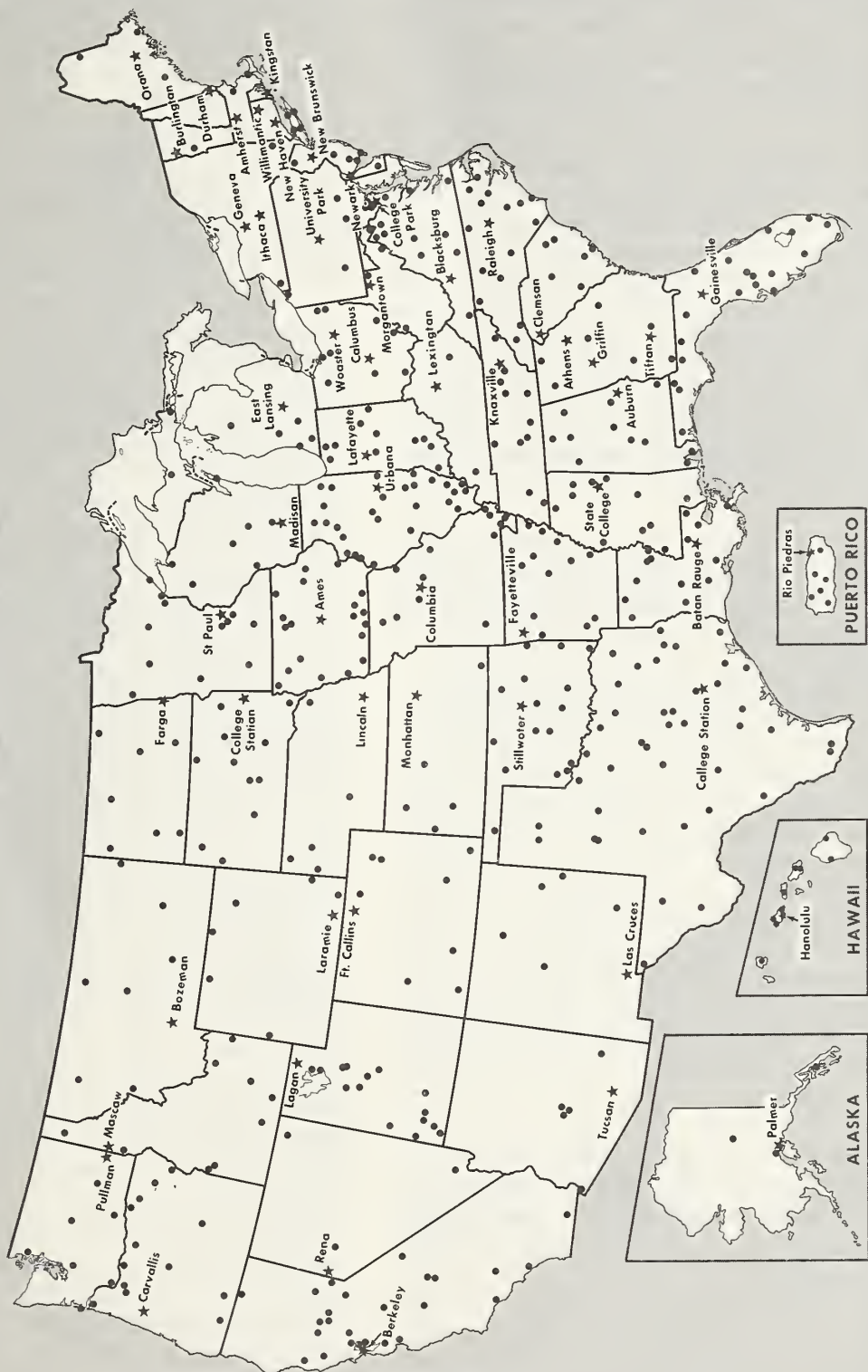
Further impetus to regional research was brought about by the Research and Marketing Act of 1946. The act provides means by which regional committees of State and Federal agriculturists can meet to plan, recommend, organize, and carry out joint research projects of a regional nature. Currently, there are 187 regional projects.

The Utilization Research and Development Divisions are located in each of the four principal regions of the United States, primarily for the purpose of finding new uses for the commodities of their regions (see p. 16). They may or may not have formal cooperative agreements with the State experiment stations. Each division laboratory has an Agricultural Experiment Stations Relations Committee, composed of the directors of the State stations in the region and a director of a Utilization Research and Development Division Laboratory. This committee meets each year to review the work at the laboratory and to discuss matters of policy. Periodic meetings of technical representatives of the State experiment stations are also held at the Division laboratory. These meetings permit informal exchange of views and technical information between the laboratory and the experiment station personnel.

Federal field stations are maintained by several research agencies in the Department at locations throughout the United States having unique advantages for the specific research to be undertaken. Federal workers and cooperative agents (joint Federal and State) are employed at State experiment stations. Both field station scientists and cooperative employees conduct work in cooperation with State experiment stations—sometimes only with the station in the State where the Federal station is located, and sometimes with other stations in neighboring States that have an interest in the problem. This pattern of cooperation has been developed voluntarily over the past 76 years. Cooperation with the State stations recognizes the autonomy of the States and their institutions. Insofar as possible, all points where differences might arise are covered by written agreements covering financial responsibility of each party, use of facilities, number of personnel, and other administrative and management matters.

State Agricultural Experiment Station System

- ★ Main Experiment Station
- Branch or Other Outlying Research Location



What steps are taken to coordinate research or to avoid duplication of research at the various Federal laboratories and field stations and State agricultural experiment stations?

Coordination of Department research is accomplished by a system of project review wherein each project is reviewed, prior to approval, by all Department agencies having a related interest or responsibility. Such projects are also reviewed by staff members of the Cooperative State Experiment Station Service (CSESS), who are familiar with similar research at the State agricultural experiment stations. Reviewing agencies consider whether proposed projects involve any unnecessary overlapping or duplication of work and whether adequate provision has been made for consultation or cooperation on problems of mutual concern.

Research projects of the State agricultural experiment stations that are financed by Federal-grant funds are initiated by the stations themselves, but they are coordinated and approved by the CSESS.

A central file of all current USDA research projects is maintained in the Central Project Office of ARS. Each current research project in the file contains information on the nature and purpose of the work and is available to all who have responsibility for the conduct or administration of agricultural research. A similar informational file on all current Federal-grant-fund research projects is maintained by the CSESS.

The scientific literature and annual reports, the national meetings of scientific societies, and the correspondence between scientists in similar fields of work are also means of acquainting scientists with work conducted elsewhere in their special fields.

Who may propose research work for the USDA and the States? How are priorities established? Who finally determines the selection of research projects?

Most research in the USDA, both fundamental and applied, results from problems faced by the people of the United States. Some of these problems are of an emergency nature, such as an animal disease outbreak or a crop insect infestation.

Others are not of an emergency nature but are important for the welfare of large groups of people and for the economy of our country. Examples of the latter type of research are studies on the composition of milk or cotton, or on the improvement of livestock. Even such basic research as that on the composition of cotton is directly related to the problems of the cotton grower, the processor, and the marketing organizations, as well as the consuming public. Problems that finally become research projects in the USDA may come from individual farmers, county and other extension workers, farmer cooperatives, processors, marketing agencies, industrial committees, or other civic groups. The problems may reach the USDA directly or through its field employees; commodity and functional advisory committees; land-grant colleges and State universities; farm directors of radio, TV, and press; or Members of the U.S. Congress.

Technological changes in any one link in the production, processing, marketing, and consumption chain may create problems extending beyond the location where the change occurs. A unified approach by several research agencies is then needed to solve the problem. Mechanical harvesting of cotton, for example, leads to changes in operation of gins and in drying practices. The end product is believed by some cotton spinners to be inferior in spinning qualities to the product they received before cotton was harvested mechanically. Currently, research is being conducted cooperatively by agricultural engineers of the ARS, spinning technicians of the AMS cotton spinning laboratory, and economists of ERS. It is designed to discover by working with cottons of known origin that receive known harvesting, ginning, drying, and spinning treatments, just what are the facts in the case and what actions are needed to correct the problems that are found. Contracts with two experiment stations and a textile research institution are helping to shorten the time needed for the project.

Under provisions of title III of the Research and Marketing Act of 1946, the Secretary has established a National Agricultural Research Advisory Committee and 23 committees that are active in advising the Department on research and marketing programs. Representatives of producers, industry, State and Federal Governments, and science make up the membership. The Re-

search and Marketing Advisory Committees for 1962 are—

Citrus and Subtropical Fruit	Grain
Cotton and Cottonseed	Home Economics
Dairy	Livestock
Deciduous Fruit and Tree Nut	Oilseeds and Peanut
Economics	Potato
Farm Equipment and Structures	Poultry
Food and Nutrition	Rice
Food Distribution	Sheep and Wool
Forage, Feed, and Seed	Soils, Water, and Fertilizer
Forestry	Sugar
	Tobacco
	Transportation
	Vegetable

In addition to the 23 Research and Marketing Committees, the Secretary of Agriculture has appointed a Committee on Agricultural Science, which represents and serves to coordinate agricultural science with the overall scientific program of the United States Government. The following excerpt explains the need for and the purpose of this committee:

APRIL 16, 1962.

SECRETARY'S MEMORANDUM NO. 1498

Committee on Agricultural Science

1. *Purpose.* A panel of the President's Science Advisory Committee has recommended the establishment of a committee of scientists to advise the Department on agricultural research. The function of such a group would include a continuing evaluation of the program of research supported by funds administered by the Department, recommending desirable changes in the existing program, and advising the Department concerning means of increasing the emphasis on, and the effectiveness of, basic research. Concurring in the need for such an advisory body, I am establishing a Committee on Agricultural Science to be composed of eminent scientists representing such disciplines as genetics, microbiology, ecology, nutrition, physiology, entomology, engineering, biochemistry, physics, rural sociology, marketing, and economics.

Research projects that require new or additional funds are included in the proposed budgets of the subject-matter agencies concerned. After passing through administrative review in the USDA and the Budget Bureau, the overall budget is presented to the Congress for appropriation of funds. The Congress usually appropriates funds for broad lines of work, such as research on insects. Specific projects written within the framework of the broad lines are developed and recommended by the subject-matter agency and approved by a research administrator or other official authorized to act on such matters. In recommending and ap-

proving such projects, USDA officials are instructed to give particular consideration to (1) their relation to other research in the USDA and at the State experiment stations, (2) their likelihood of producing results, (3) their scientific merit, and (4) the availability of funds, facilities, and personnel.

State experiment station research originates in much the same way as does Federal research. Major problems encountered by farmers, extension workers, rural communities, and local processing or marketing agencies are brought to the experiment station. The station director, in consultation with his technical and scientific staff, determines priority. Station projects may be carried on under State funds, private endowment, or Federal-grant funds. All Federal-grant fund projects are reviewed and approved by the CSESS, as required by Federal law governing use of such funds.

How are new varieties of plants developed through research so as to benefit farmers? What steps are taken to prevent their exploitation and sale at exorbitant prices?

Promising strains of plants developed in cooperative breeding work by the USDA and the States are evaluated in field tests at many locations. Strains resulting from crosses or plant combinations by State or Federal breeders also may be tested under various climatic and soil conditions to determine their adaptability.

Once tests have indicated the superiority of a particular selection over existing varieties, experiment stations planning to release the selection for production arrange for increasing the seed in quantities sufficient to furnish supplies to crop improvement associations. At this time the new variety is officially named. The crop improvement associations are made up of outstanding farmers who are especially equipped to produce the seed under conditions that will insure its genetic purity. Association members build up commercial stocks of the seeds or plants and place them on the market for purchase by farmers and other growers. Essentially the same system is followed in the release of nursery stocks, although the increase may be made vegetatively by cuttings from planting stocks released to nurserymen equipped to make such increases.

Generally, new varieties of crop plants are adapted to more than one State, in which case the foundation seeds are released to all appropriate States at the same time. Hence, when the seeds reach the commercial stage, they are available in a wide area and are in the hands of a number of commercial producers. Crop improvement associations are so organized that prices are controlled to the extent that the commercial seed producers get a reasonable, but not exorbitant, profit for the extra care and work needed to produce the foundation seed.

When marketing research develops new equipment, such as a quality measurement or a new packing device, what steps are taken to prevent these devices being sold at exorbitant prices?

When a new device is developed by AMS marketing research, a public patent is issued. The Secretary of Agriculture may license production of the device. Licenses are granted to anyone who wishes to manufacture the product, at no charge or royalty. Full test data and plans are made available without charge to the manufacturer. The USDA researcher who made the discovery relinquishes all claim to the invention. If the manufacturer ever exploits the patent, his license may be revoked by the Secretary of Agriculture. All USDA research results belong to the public.

What is the Agricultural Research Service? How is it organized? What are the functions of its constituent divisions? Do they cooperate on research problems or is each operated independently?

AGRICULTURAL RESEARCH SERVICE

The Agricultural Research Service (ARS) is the primary agency of the USDA engaged in agricultural research, and the ARS Administrator coordinates all research activities of the USDA. This agency was established in 1942 as the Agricultural Research Administration, to consolidate most of the physical, biological, chemical, and engineering research in the Department. In the reorganization of 1953, when it was renamed ARS, research in farm economics was also in-

cluded in its activities. In 1957, the organizational pattern, functions, and authorities of ARS were reassessed and adjusted to achieve the following primary objectives: (1) To provide recognition of the expanded interest in and importance of utilization research; (2) to provide organizational recognition in proportion to the current significance of the USDA's overall objectives; and (3) to provide an organizational pattern more comparable to those of similar units in the USDA. This organization was specifically designed to carry out the functions and authorities delegated to the ARS Administrator.

The readjustment resulted in the following essential changes:

Research programs were grouped according to similarity of scientific disciplines, relationships, and joint interest in areas of basic research to permit closer coordination in planning and executing both basic and applied research. Various research and regulatory divisions and branches, other than those concerned with home economics, were grouped into four organizational units covering Utilization Research and Development, Farm Research, Regulatory Programs, and Experiment Stations. Each of the four groups reported to a Deputy Administrator. A fifth group, the Institute of Home Economics, which reported directly to the Administrator, was established.

Provision was made for increased emphasis on basic research.

In 1961, the following changes in the organization of ARS were made:

Farm Economics research work was removed from ARS. The State Experiment Stations Division was changed to Cooperative State Experiment Station Service (CSESS), under an Administrator, and was removed from ARS. The Institute of Home Economics was changed to Nutrition and Consumer-Use Research, under a Deputy Administrator, and Household Economics Research Division was changed to Consumer and Food Economics Research Division. Research Planning and Coordination was established under a Deputy Administrator responsible for the Central Project Office and the Research Advisory Committees. The Territorial Experiment Stations Division was changed to Tropical and Subarctic Agricultural Program and was assigned to the Crops Research Division of ARS.

Functions of the Agricultural Research Service.—The ARS is responsible for—

1. The following research programs: Farm and utilization (except forestry) research; soil and water conservation, except the national soil survey; control of undesirable plants; grass and range management, except on forest and related ranges (the

- term "forest" includes woodlands and brush-covered wildlands in mountainous areas); cotton ginning and processing; and certain research under the Housing Act of 1949.
2. The research investigations, inspections, experimentations, demonstrations, development work, service and regulatory work, control and eradication of insect, plant, and animal pests and diseases provided for in the Department of Agriculture Appropriation Act of 1954 (except forest pests and diseases, and research on off-farm handling, transportation, and storage of agricultural products, including investigations of insect infestations of on- and off-farm stored products); inspection, certification, and identification of foods for dogs, cats, and other Carnivora; inspection and certification service of animal byproducts not for use as human food; identification and certification (for export) of federally inspected meat, meat byproducts, and meat food products.
 3. Administration of the Federal Insecticide, Fungicide, and Rodenticide Act.
 4. Administration of the provisions of section 408(1) of the Federal Food, Drug, and Cosmetic Act, as added by section 3 of the Miller Act of July 22, 1954, providing for certification with respect to certain pesticide chemicals for which tolerances or exemptions are sought.
 5. Emergency eradication activities relating to contagious diseases of animals and poultry.
 6. Administration of the Hog Cholera Serum and Virus Marketing Agreement Act.
 7. Establishment of humane methods of slaughter of livestock and poultry.
 8. The program of payments to Puerto Rico under the Hatch Act of March 2, 1887, as amended (including the consolidation amendment in Public Law 352 (84th Cong.)), and supplemental and related acts.
 9. Administration of title III of the Research and Marketing Act, including responsibilities, functions, and operations of national advisory committees.
 10. All administrative functions on behalf of the Secretary relating to the acquisition and administration of patent rights.
 11. Administration of responsibilities delegated to the Secretary, effective September 8, 1954, pursuant to section 201(b) of the Federal Civil Defense Act of 1950 (64 Stat. 1248), by the Federal Civil Defense Administrator, which involves planning a national program and directing Federal activities concerned with research, diagnosis, strengthening of defensive barriers, and control and eradication of diseases, pests, or chemicals introduced as agents of biological or chemical warfare against animals or crops.
 12. Use, administration, and disposition under title III of the Bankhead-Jones Farm Tenant Act and the related provisions of title IV thereof of lands which heretofore have been transferred or which hereafter may be transferred by agreement between the interested agencies with the approval of the Assistant Secretary.
 13. Development and negotiation of foreign contracts and grants program under sections 104 (a) and (k) of Public Law 480.
- The functions of ARS do not include work on forest pests and diseases. This phase of work is the responsibility of the Forest Service of the USDA. Nor does ARS have responsibility for research on off-farm handling, transportation, and storage of agricultural products, including investigations of insect infestations of on- and off-farm stored products. This is specifically a function of the Agricultural Marketing Service of the USDA.
- Additional functions for which responsibility rests with agencies other than ARS are described under functions of the Agricultural Marketing Service; Cooperative State Experiment Station Service; Economic Research Service; Farmer Cooperative Service; Forest Service; Federal Extension Service; National Agricultural Library; Soil Conservation Service; and Statistical Reporting Service.
- Reservations.**—Final action in proceedings pursuant to sections 7 and 8 of the Administrative Procedure Act, except orders in rulemaking proceedings under the Hog Cholera Serum and Virus Marketing Agreement Act, is reserved to the

Judicial Officer. *The following are reserved to the Secretary:*

1. Final action on regulations under the Hog Cholera Serum and Virus Marketing Agreement Act, previously requiring approval of the President.
2. The issuance, amendment, termination, or suspension of any marketing agreement or order or any provision thereof.
3. Designation of members of advisory committees under title III of the Research and Marketing Act.
4. Determination as to the measure and character of cooperation with Mexico in the foot-and-mouth disease program pursuant to section 1 of the act of February 28, 1947, the designation of members of advisory committees, and the appointment of commissioners on any joint commission with the Government of Mexico set up under such program.
5. Approval of requests for apportionment of reserves for emergency outbreaks of insect pests and plant diseases.
6. Determination of emergencies in connection with the eradication of foot-and-mouth disease and other contagious diseases of animals and poultry.

Publicly supported agricultural research in the United States.—Publicly supported agricultural research conducted in the United States includes: (1) Work done at State stations financed by Federal grants and administered locally with overall statutory responsibility for use of funds vested in the CSESS; (2) work done in tropical and subarctic agriculture and administered by the Crops Research Division of ARS; (3) work done and administered by the various Utilization Research and Development Divisions; (4) work done by agencies in the USDA other than ARS but coordinated by the ARS Administrator; (5) contract research financed from Federal funds and executed by private and public institutions and industrial concerns having unique and singular facilities and skills not otherwise immediately available to the USDA; and (6) work done at State stations financed under State appropriations.

Increasing contributions to basic and applied research are being made by private industries, foundations, and other institutions. USDA research workers maintain close, informal relationships with private research workers through lit-

erature, correspondence, scientific meetings, and conferences.

ORGANIZATION OF RESEARCH DIVISIONS AND REGULATORY PROGRAMS IN ARS

The research divisions and regulatory programs within ARS are distinct functional and administrative units, but their work is subject to coordination by the ARS Administrator (see fig. 3). Cooperation between divisions is encouraged. Research that falls within the province of two or more divisions is usually conducted cooperatively by the divisions concerned. For example, research on forage crop improvement might include work by the Crops Research Division on the breeding of more productive forage plants, and work by the Animal Husbandry Research Division on the feeding value of different forage plants. Cooperative research is also common between Utilization Research and Development, Farm Research, Nutrition and Consumer-Use Research, and Regulatory and Control programs.

An example of interprogram research is the joint project to find new drugs by Farm Research and by Utilization Research and Development. Plant explorers are sent to all parts of the world by Farm Research to seek plant materials having potential value as sources for new drugs. The plant materials collected are screened by chemists in the Utilization Research and Development laboratories for certain properties indicating potential value. The materials showing promise are then analyzed by pharmacology specialists in the National Institutes of Health of the Department of Health, Education, and Welfare at Bethesda, Md. Cooperative research of this nature with organizations outside of ARS is common—sometimes it involves formal arrangements such as memorandums of understanding and contracts, and sometimes only informal collaboration.

Pioneering Research Laboratories have been set up in the research divisions for fundamental research on: Mineral nutrition; plant physiology; plant virology; insect pathology; insect physiology; blood antigens; basic animal genetics; microbiological chemistry; chemistry of animal proteins; allergens in agricultural products; plant fibers; seed proteins; plant enzymes; cellular metabolism; physics of fine particles; and plant hormones and regulators. These laboratories are staffed by scientists whose main objective is to follow all possible leads in an effort to find

new information of a basic and fundamental nature in areas in which knowledge is incomplete or lacking.

FARM RESEARCH

A Deputy Administrator is responsible for the proper administration of several research divisions concerned with problems in agricultural engineering, animal disease and parasites, animal husbandry, crops, entomology, and soil and water conservation.

The **Agricultural Engineering Research Division** conducts a national research program and related functions on the efficient use of power, labor, materials, machines, and structures in farming. It deals with problems of storage, transportation, and housing of general and specialized farms; equipment needs for pest control; environmental factors affecting the growing and storing of farm products; and the influence of environment on the health and production of farm animals, and on the housing of the farm family. Studies are directed toward improving farm machinery and equipment for the many farm production operations; improving and developing methods of conditioning hay and grain; improving cotton ginning and packing; and preparing various other crops for use on the farm or for sale. Research is also conducted on development of income-producing uses of electricity on the farm, including automatic controls, power, light, and other forms of electromagnetic radiation. Studies of farm structures are made to improve the design of farm storages and service buildings for efficient operation, strength, and economy in materials and construction. Farm housing research involves the engineering phases of designing and planning more livable farm homes.

The **Animal Disease and Parasite Research Division** directs a national research program and related functions on diseases and parasites that affect domestic animals, fur-bearing animals raised in captivity, and poultry. It seeks to learn how infectious diseases and harmful parasites are transmitted, and to develop improved methods for their diagnosis, prevention, eradication, and control.

The **Animal Husbandry Research Division** directs a national research program and related functions on animal husbandry. It conducts research in the breeding, feeding, nutrition, and management of dairy cattle, and in the physiology

of milk secretion and of reproduction, with the purpose of developing more efficient dairy herds and lowering the cost of milk production. It supervises the national cooperative Dairy Herd Improvement Program designed to aid dairy farmers.

The Division studies the effects of feeding and nutritional variations on animals and poultry, and seeks better feeds and feeding methods. It also studies the effects of breeding, feeding, management, age, and sex on the quality and usefulness of animal and poultry products. It supervises national plans for improving production and breeding qualities of chickens and turkeys and for reducing their mortality.

The **Crops Research Division** is concerned chiefly with improving the efficiency of production and quality and reducing the hazards of production of the following field and horticultural crops: Cereal, cotton and cordage fiber, forage and range, fruit and nut, oilseed and industrial, tobacco and sugar, and vegetable and ornamental. Attention is also given to introduction and development of new or specialized crops. The overall research objective is to develop varieties of crops with more efficient yields, better quality, and resistance to diseases, nematodes, insects, heat and cold, and drought.

The Division also investigates the use of cultivation, competitive crops, pasturage, herbicides, and other means for brush and weed control in cultivated crops, pastures, and rangelands. It conducts research on cultural practices of crops, including reseeding, fertilizing, and grazing management of pastures and ranges. It introduces, tests, and maintains seeds and plants of promising species from foreign countries for possible domestic use and for genetic improvement of crops now grown. It directs activities of the National Arboretum for research and education concerning tree and plant life. It studies chemicals used in crop production such as those used for treatment of cuttings to stimulate root formation; for prevention of preharvest fruit drop; for blossom thinning; for quick ripening; for producing better flavor and nutrition; and for controlling or eliminating undesirable plants, nematodes, and disease-causing organisms.

Fundamental research conducted by this Division includes modes of inheritance of desirable plant traits and studies of pathology, ecology, physiology, morphology, and cytology of the plants in the interest of obtaining an adequate

understanding of transmission of desirable characters, disease control, and relations between environment, cultivation, yield, and quality.

The Division conducts a Tropical and Subarctic Agricultural Program in Alaska, Puerto Rico, and the Virgin Islands.

The **Entomology Research Division** conducts a national research program and related functions on insects (except those affecting forests and on- and off-farm stored products and packaging and other products in the channels of trade) to develop practical methods for destroying harmful insects and for promoting the increase and spread of beneficial insects, including honey bees. Insecticide research includes the development of new insecticides and improved methods and equipment for their application, and the study of insect resistance to insecticides. Research on biological and cultural methods of control and on control by use of resistant varieties of crop plants is also conducted.

The Division conducts research in foreign countries to locate natural enemies of insect pests and noxious weeds that occur in the United States, and imports desirable species. Its scientists study insects that destroy or damage fruit, vegetable, feed, forage, and fiber crops and those that annoy or affect the health of man and animals, including pests that infest human habitations. They classify and identify insects and seek to develop methods, equipment, and apparatus to aid in enforcing plant quarantines and eradication or control of insect pests and plant diseases.

The **Soil and Water Conservation Research Division** directs a national research program and related functions in the field of soils, water, fertilizers, hydrology, sedimentation, runoff, design of hydraulic and conservation structures, effects of land use and treatments on conservation of soil and water, engineering design aspects of drainage and irrigation, and the effects on output of alternative systems of conservation farming. The program also involves research in soil chemistry, physics, microbiology, and relation of soils to plant and animal nutrition. The Division compiles data on resources, supplies, production, and consumption of fertilizers and plant nutrients.

By investigating the relations between the soil and the crops it produces, research workers seek to develop a better understanding of the various soils of the country and to find ways of increasing their fertility and productivity, including man-

agement systems that will conserve soil resources. Soil management studies involving many broad problems such as those associated with soil structure, or with saline and alkaline conditions, are carried out on major soils in the humid and dry-land regions and under irrigation. Fertilizer investigations include study of qualities of various fertilizing materials, methods of analysis, and effects of various chemicals on yields and other characteristics of crop plants.

This Division collects and interprets facts about the influence of land-use patterns on runoff, erosion, sedimentation, and flood damage as a means of developing information needed for watershed management, flood prevention, and sediment control in streams and reservoirs throughout the United States.

FOREIGN RESEARCH AND TECHNICAL PROGRAMS DIVISION

This Division reports directly to the Research Administrator and assists the Administrator by carrying out various assignments having international research aspects. Primary responsibilities are as follows:

1. The Division administers a foreign agricultural research program financed by foreign currencies that accrue to the credit of the United States through sale of excess agricultural products under authority of Public Law 480. It also negotiates and executes grants and contracts with foreign institutions in the broad areas of market development; marketing; human nutrition; and economic, farm, and forestry research on projects of mutual interest to the United States and the countries involved. Since research divisions in the Agricultural Research Service, the Agricultural Marketing Service, the Economic Research Service, and the Forest Service are responsible for the technical aspects of the research undertaken overseas, the Foreign Research and Technical Programs Division cooperates closely with these agencies in the development and conduct of this program.

2. The Division has responsibility for the development of training programs for foreign nationals seeking specialized agricultural research information. In carrying out this function, the Division works closely with the Foreign Agricultural Service; other divisions of the Agricultural Research Service; the land-grant colleges; the Agency for International Development; United

Nations agencies such as FAO, UNESCO, and ILO; and others.

3. The Division has responsibility for technical consultation and support activities. This program furnishes technical information developed through agricultural research to U.S. missions overseas.

4. The Division coordinates and administers the Department's foreign translation program and cooperates closely with the National Science Foundation in securing English translations of foreign technical materials needed by U.S. scientists for reference purposes.

5. The Division represents and acts for the Research Administrator as assigned on various committees engaged in international activities.

6. The Division also coordinates visits to all ARS offices, laboratories, and field stations by both foreign and domestic visitors.

NUTRITION AND CONSUMER-USE RESEARCH

A Deputy Administrator heads this research. The divisions are concerned with national programs on the following subject matters:

The **Clothing and Housing Research Division** is concerned with and evaluates the serviceability of clothing and household textiles in relation to consumer needs; to properties of fabrics; and to construction, design, care, and reconditioning of garments and homefurnishings. It determines the characteristics of housing and household equipment needed to meet family requirements for efficient housekeeping and comfortable living. It develops information basic to wise planning, improved use, and care of clothing; household textiles; and the house—its equipment and its facilities.

The **Consumer and Food Economics Research Division** is concerned with and investigates levels of food consumption and nutritive value and economy of customary diets of various population groups. It conducts research on patterns of rural family expenditures; household production for family use; and economic problems of household management, including the effect of the economic situation on family living. Recommendations are developed for effective and economical use of food and other family resources for higher levels of living. The Division cooperates with other Federal and State agencies in the coordination of nutrition programs.

The **Human Nutrition Research Division** is concerned with and conducts studies on the nutritive requirements of people, the composition and nutritive value of food to meet these needs, and the physiological availability of nutrients in foods. It develops new and improved methods of preparing, preserving, and caring for foods in homes and institutions to obtain the best nutritive values from food purchases; to prevent deterioration in food quality; to make foods more acceptable in meals; and to make best use of abundant or new foods on the market.

REGULATORY AND CONTROL PROGRAMS

The ARS also has functions and responsibilities in the administration of various regulatory and control activities, as follows:

The **Animal Disease Eradication Division** administers laws and regulations to prevent the spread of diseases through interstate shipments of livestock and poultry, and to insure humane treatment of transported livestock. It conducts nationwide State-Federal cooperative programs and assists and cooperates with foreign governments in measures to control and eradicate livestock and poultry diseases. This Division provides Federal inspection at stockyards and assists States in the diagnosis of unknown diseases.

The **Animal Inspection and Quarantine Division** administers laws and regulations to protect our livestock and poultry from diseases of foreign origin; to assure the humane exportation of only healthy livestock; to prevent the production and sale of harmful and worthless veterinary biologics; and to maintain, through a marketing agreement with manufacturers and handlers, adequate supplies of serum and virus for the protection of swine against hog cholera.

The **Meat Inspection Division** administers laws that insure the wholesomeness of domestic and imported meat and meat food products from cattle, sheep, swine, goats, and horses; inspects and certifies canned and frozen food for cats, dogs, and other Carnivora; provides continuous inspection of "processed butter" manufacture; and designates methods of humane slaughter of livestock.

The **Pesticides Regulation Division** administers the Insecticide, Fungicide, and Rodenticide Act of 1947, as amended August 1959; and it enforces the provisions of the Miller amendment to the Food, Drug, and Cosmetic Act that pertain to the USDA.

United States Department of Agriculture



The **Plant Pest Control Division** conducts cooperative programs to eradicate, suppress, or control insect pests and plant diseases, including new introductions established in limited areas within the United States. It combats emergency outbreaks of insects or plant diseases that require organized control effort over wide areas, and leads a nationwide insect survey as a basis for forecasting insect outbreaks and advising industry and farmers as to needed controls.

The **Plant Quarantine Division** administers laws and regulations designed to prevent the entry of plant pests into the United States from foreign countries and the movement of such pests from U.S. offshore areas to other parts of the country. This involves quarantines and regulations affecting plants and plant products; soil; plant pests as such; and carriers, including means of transportation. The Division also inspects and certifies domestic plants and plant products for export to meet plant quarantine import requirements of countries of destination.

NOTE: In the course of administering the regulatory and control activities prescribed by law, officials often encounter problems requiring factual information for solution. These problems are referred to the Administrator and are assigned to the proper research divisions for study.

UTILIZATION RESEARCH AND DEVELOPMENT

A Deputy Administrator is responsible for the proper administration of four research divisions concerned with problems related to finding new or improved methods of utilizing agricultural materials by seeking to develop new and improved products from agricultural commodities; to finding better commercial methods for preserving foods and feeds; and to increasing the use of farm crops and byproducts as industrial raw materials. Each division works primarily on the major crops of its region. Four large laboratories and nine smaller research stations are under the direction of the regional divisions of their areas.

The **Eastern Utilization Research and Development Division**, with headquarters at Wyndmoor (Philadelphia), Pa., and laboratories at Beltsville, Md., and Washington, D.C., conducts research and development work on utilization problems of concern to agriculture and industry in the eastern region of the United States. The Division works with animal products—dairy, meat, fats, and leather; plant products—eastern fruits and vegetables, tobacco, honey, maple, and

new crops; and the chemical and immunochemical nature of allergens of agricultural products.

The **Northern Utilization Research and Development Division**, with headquarters at Peoria, Ill., works with cereal grains—corn, wheat, barley, grain sorghum, and oats; oilseeds—soybean, flaxseed, safflower, and erucic acid-containing oilseeds; and new crops.

The **Southern Utilization Research and Development Division**, with headquarters at New Orleans, La., and field stations at Raleigh, N.C., Olustee and Winter Haven, Fla., and Weslaco, Tex., works with cotton and cottonseed; tung oil; pine gum; southern fruits and vegetables, including citrus, sweetpotatoes, and cucumbers; sugarcane; rice; peanuts; and new crops.

The **Western Utilization Research and Development Division**, with headquarters at Albany, Calif., and field stations at Pasadena, Calif., and Puyallup and Prosser, Wash., works with western fruits, nuts, vegetables, and rice; poultry products; forage crops; wheat; barley; wool and mohair; sugarbeets; dry beans and peas; castorbeans; and new crops.

The **Product and Process Evaluation Staff**, with headquarters in Washington, D.C., provides counsel and advisory assistance of a staff nature to the Deputy Administrator in the evaluation of industrial practicability and market potential of products or processes that might be developed as a result of research by the Utilization Research and Development Divisions.

What is the relationship of the Agricultural Research Center to the total research program of the USDA? What type of research is carried on at the Center? How many people are employed there?

The Agricultural Research Center (ARC) is located near Beltsville, Md., about 15 miles northeast of Washington, D.C. The activities of the Center are administered by the ARS Administrator's Office. The Center had its beginning in June 1910, when 475 acres of land were purchased east of Beltsville for the purpose of establishing an experimental farm to be used by the Animal Husbandry and Dairy Divisions of the then Bureau of Animal Industry. The first major building erected at the station was the large concrete dairy barn nearest to Powder Mill Road. This

barn was erected in 1916, and soon thereafter parts of the present Dairy Physiology and office buildings were built. On July 1, 1924, a separate Bureau of Dairy Industry was established and allotted 190 acres of the original tract of land. In 1925, the Bureau of Dairy Industry purchased an additional 129 acres of land; and in 1926 and 1927, approximately 1,000 acres of land were purchased and added to the Animal Husbandry tract. In 1930, the Hayden tract of 920 acres was leased with option to purchase. The major acquisition of land was in 1937, when the Secretary of Agriculture transferred over 7,000 acres from the Farm Security Administration. Few buildings were erected at the Station until after the acquisition of the 1,000 acres in 1926 and 1927. Between these dates and 1933, several buildings for Zoology, Poultry, and Dairy Industry were erected.

In July 1933, it was decided to concentrate additional departmental activities at Beltsville into one large Federal agricultural research center. During the remainder of 1933 and 1934, funds were allotted to expand the activities at this location. On August 28, 1934, the Center was established and designated as the "Beltsville Research Center." In 1935 it was renamed National Agricultural Research Center; in 1939 it was renamed Beltsville Research Center; and in 1946 it was again renamed Agricultural Research Center. Further expansion of the ARC was effected in the reorganization of 1953, when the Plant Industry Station was made a part of the ARC.

The ARC occupies two separate tracts of land on opposite sides of U.S. Highway No. 1. On the northwest side of the highway, 2½ miles northeast of the University of Maryland, is the Plant Industry Station, which covers approximately 1,000 acres. The larger tract of the ARC covers approximately 10,000 acres and lies to the east of the Baltimore & Ohio RR., which parallels U.S. Highway No. 1. Most of the research divisions within ARS do a part of their research at the ARC, and some of them maintain headquarters there. The Market Quality Research Division of AMS and a few other Federal agencies use the facilities of ARC. About 2,800 persons are employed at the Center.

The facilities of ARC include 1,160 buildings of all types equipped to meet specific research needs or to provide office and laboratory space. About 3,800 experimental farm animals, 11,000 mature fowls, and 3,500 small laboratory animals are kept

at the ARC. There is an apiary for bees. In 36 greenhouses, 5 acres are under glass. There are experimental pastures, ranges, orchards, gardens, fields for cultivated crops, timber stands, and soil-treatment plots.

From the standpoint of research coordination, the ARC is closely related to the total research program of the USDA. For an attack on one problem, it is possible to make use of the experience and abilities of many different kinds of scientists assembled in one place.

An example of research coordination with the State experiment stations is the fundamental breeding work whereby new plants are developed at the ARC and then sent to stations in various parts of the United States for further development or adaptation.

Most of the research at the ARC deals with problems of national interest. Much of it is basic or fundamental research, with the goal of accumulating scientific information that can be applied elsewhere in finding solutions to specific, practical problems.

What is the Agricultural Marketing Service? How is it organized? What are the functions of its research divisions?

AGRICULTURAL MARKETING SERVICE

The Agricultural Marketing Service (AMS) was formed in 1953, when the marketing functions, including research, of the Bureau of Agricultural Economics, the Production and Marketing Administration, and the Agricultural Research Administration were brought together in one organization. (The economic and statistical units of AMS were reorganized into separate agencies in 1961.) In general, AMS is responsible for physical and biological science aspects of marketing research of agricultural products from the time they leave the farm until they reach the final user, including on- and off-farm research on stored products insects. It is also responsible for marketing service and regulatory functions of the USDA having to do with marketing food and other farm products.

ORGANIZATION OF RESEARCH, SERVICE, AND REGULATORY PROGRAMS IN AMS

The research, service, and regulatory activities of AMS are conducted under deputy administrators. However, their work is coordinated informally among the several deputy administrators

and formally by the AMS Administrator and the Associate Administrator. For example, some of the research of the Market Quality Research Division on the quality measurement of fruits and vegetables might be done in cooperation with the Fruit and Vegetable Division grading and standardization personnel. Likewise, research in the Transportation and Facilities Research Division on engineering efficiency in the operation of broiler plants is of interest to the Poultry Division, which is responsible for inspecting poultry for wholesomeness and grading it for quality.

AMS research, regulatory, and service workers maintain close contact with each other as well as with numerous private industries, foundations, and State agencies engaged in marketing work. Very often AMS research is conducted at the request of private grower or marketing groups. In some cases, the requesting groups finance all, or part, of the research.

MARKETING RESEARCH

The AMS Administrator is responsible for the administration and operation of marketing research programs conducted by the two research divisions described below. Overall coordination of marketing research with other research in the Department is the responsibility of the Administrator of ARS. (For other marketing research, see sections on ERS, FCS, FS, and SRS.)

The **Market Quality Research Division** conducts a national research program designed to eliminate waste and spoilage and to better measure and maintain the quality of food, feed, and fiber after it leaves the farm.

Insects represent a quality problem for almost every agricultural product. Many appear after the product has left the farm. In their attack on insects, marketing entomologists conduct research on eliminating and controlling insects during farm storage, transportation, processing, packaging, storing, wholesaling, and retailing, and even in packaged foods on kitchen shelves in the home. Recommendation for using premium grade malathion as an effective insecticide on stored peanuts, wheat, and shelled corn has resulted from AMS marketing research.

Marketing scientists are constantly studying the proper storage and transportation environments for fruits and vegetables. For example, the use of polyethylene liners was developed and tested for Golden Delicious apples by AMS scientists.

This development has extended the market life of the fruit and is bringing more income to farmers and a better quality product to consumers. Other work in the field has led to the use of polyethylene lug liners for cherries, poly overwraps for tomato plants, and liners for lettuce crates. AMS research is also responsible for the use of hydro-cooling and vacuum cooling to quickly remove field heat from a variety of products, such as lettuce. The market quality work on meat, poultry, eggs, dairy products, grain, seeds, and cotton completes a well-rounded quality research program.

Pioneering research and instrumentation laboratories have been set up within the Market Quality Research Division. The Pioneering Research Laboratory does basic research on post-harvest physiology—what happens within the cells of living things, such as fruits and vegetables, after they are harvested.

The Instrumentation Laboratory works on instruments that measure quality objectively but that do not destroy the product. Usually this takes the form of developing machines that automatically measure such things as water core in apples, hollow heart or black spot in potatoes, and juice color in tomatoes.

The research of this Division covers a wide range of scientific disciplines, such as plant pathology and physiology, chemistry, physics, entomology, and engineering.

The **Transportation and Facilities Research Division** is responsible for increasing efficiency and holding down costs of moving agricultural products from growers to consumers. This research includes studies of the efficiency of handling equipment, such as forklift trucks, conveyor belts, clamp trucks, box fillers, and all the items that touch food or its container in the marketing system. In addition, this research develops plans for and promotes construction of marketing facilities of all kinds—grain elevators, packing plants, retail stores, cotton warehouses, wholesale facilities, packing sheds, terminal markets, livestock markets, and processing plants, to name only a few. Research to improve transportation equipment, methods, and practices is also conducted.

In every case, marketing research is designed to increase efficiency and hold down marketing costs. For example, new wholesale fruit and vegetable markets have been designed for many cities such as Atlanta, Philadelphia, and St. Louis. These markets are saving farmers, marketing

agencies, and consumers millions of dollars a year and are making it possible for a better quality product to reach consumers. Other research has led to establishing a new standard method for measuring heat leakage in refrigerated truck trailers, thus assuring a better quality product for the market. A completely automatic egg packing line, developed by AMS marketing researchers, is cutting the cost of handling eggs. Recommendations for more efficient produce handling in retail stores are helping hold down the marketing bill.

The staff of this Division is largely made up of industrial and other types of engineers and of marketing specialists.

SERVICE, REGULATORY, AND FOOD DISTRIBUTION PROGRAMS

The Agricultural Marketing Service also administers a variety of nationwide service, regulatory, and food distribution activities, as follows:

There are seven commodity divisions—Cotton Division, Dairy Division, Fruit and Vegetable Division, Grain Division, Livestock Division, Poultry Division, and Tobacco Division.

In general, each administers market news, development of grade standards, grading and inspection, or classing or testing programs for one or more commodities. Marketing agreements and orders are generally administered by the commodity division, with those for milk administered by the Milk Marketing Orders Division. A special office, the Matching Fund Program, administers and coordinates marketing service work performed by State departments of agriculture under joint State and Federal funds.

The appropriate commodity division administers each of the following regulatory acts: Export Fruit Acts, Perishable Agricultural Commodities Act, Produce Agency Act, Standard Containers Act, Federal Seed Act, and Tobacco Plant and Seed Exportation Act. The Packers and Stockyards Act is administered by the Packers and Stockyards Division.

The **Special Services Division** is responsible for Defense Food Management, Freight Rate Services, and administration of the U.S. Warehouse Act.

The **Food Distribution Division** administers the National School Lunch Program, Special Milk Program, Plentiful Foods Program, Direct Distribution Program (domestic and through volun-

tary agencies overseas), and Food Stamp Program.

All these programs are designed to promote fair and efficient marketing practices and to make use of America's agricultural abundance to meet human needs.

These programs require research assistance for their improvement or evaluation from the marketing research divisions of AMS or from other research units of the USDA.

What is the Economic Research Service? How is it organized? What are the functions of its research divisions?

ECONOMIC RESEARCH SERVICE

The Economic Research Service (ERS) conducts programs of research in agricultural economics, including both domestic and foreign marketing.

The **Economic and Statistical Analysis Division** carries out a program of economic and statistical analysis of factors affecting agricultural prices and income; long-range projections of the agricultural economy; commodity outlook and situation; food demand, consumption, and supply; farm population and rural life; agricultural history; and, when needed, related aspects of national security.

Economic research measures how agricultural prices and income respond to changes in marketing, in consumer incomes, and in other factors. It involves the continuing analysis of the current situation and trends and the broad relationship between the farm economy and the national economy. Long-range projections of economic growth and demand for farm products include appraisals of domestic food requirements and the balance between supply and market outlets.

In the area of farm population, ERS is responsible for research on farm manpower, levels of living, and rural problems and trends, including some projects oriented to the needs of the rural development program. ERS agricultural historians trace the major developments in farming and record for the future the changes in USDA policies, programs, and organization.

Periodic outlook and situation reports and publications presenting results of special analyses provide the general public with a continuing flow of economic information on agriculture.

The **Marketing Economics Division** conducts economic research and analyzes data on agricultural marketing costs and margins for specific agricultural commodities; on the organization, structure, and practices of commodity markets; on transportation costs and services; on potentials for market expansion of agricultural products and byproducts; and on merchandising, advertising, and promotion of farm products. The aim is to reduce costs, increase efficiency and returns to producers, and give consumers the products they want. Special attention is given to farm products in surplus supply.

In addition, this Division is concerned with the economic impact of Government programs and the effects of Federal, State, and local laws and taxation on distribution and marketing of agricultural products.

In an attempt to find new research methods and techniques, the Division conducts exploratory research on economic and statistical theory related to marketing. The results of marketing and statistical research throughout the USDA and elsewhere are continuously reviewed and analyzed.

The **Farm Economics Division** administers a national and regional program of economic and statistical research on agricultural adjustments, including the economics of farm management and conservation practices; the economics of farm size, including family farms; the changing structure of agriculture and the appraisal of alternative farm programs; farm finance, including farm capital, credit, and financial condition; farm taxation and local rural government; agricultural risks and insurance; and farm real-estate values and valuation.

The Division conducts research on current and future farm output, production needs and prospects, and agricultural productivity; current and potential changes in farm technology, including the use of farm machines, structures, and fertilizers, and the changing livestock-feed relationships; farm labor; and trends in costs and returns on 40 important types and sizes of farms.

The Division makes economic studies of current and potential land and water resource needs, supplies, use, conservation, and development; land tenure and leasing; legal-economic aspects of water law and administration; rural zoning and other land-use regulatory measures; organization and operation of resource districts; and policies and programs for the protection and management of

land and water resources, including economic assistance to action agencies engaged in watershed and river basin protection and development.

The Division conducts research on the problems of low-income rural families and rural areas development, including analyses of opportunities for income improvement through improved use of available area resources and industrial employment, and economic analyses and appraisals of rural area development programs. Economic research for the Department's Rural Areas Development Program and coordination of the rural development research program of ERS are centered here.

Supply, demand, and trade in farm products in foreign countries all exercise a vital impact on current and prospective U.S. agricultural exports. The **Regional Analysis Division** carries on continuous economic analysis and interpretation of conditions and developments affecting these factors and conducts research on the total food and agricultural situation by country and by region. Results of these analyses are published as regional and world food balance reports and in *The World Agricultural Situation*.

The Division conducts economic intelligence research for other U.S. Government agencies and the Congress and serves as the Department source of information on the current situation, trends, and potentials in the general and agricultural economies and the trade potential of various foreign countries.

In collaboration with FAS, the Regional Analysis Division develops world crop and livestock production estimates. The Division represents ERS and the Department at bilateral, multilateral, and international trade and economic conferences, and coordinates Department policies relating to world food needs and developments affecting demand for and supply of farm products in foreign countries.

In the field of foreign economics, the **Development and Trade Analysis Division** conducts economic analyses and statistical programs relating to trade and export of U.S. farm products and world trade patterns. It analyzes and appraises foreign economic development, farm export programs, and foreign trade policies affecting foreign markets for U.S. farm products. Included are monetary and financial problems of foreign countries affecting exports and imports of farm products and the effects of Public Law 480 and other

farm export programs on trade and economic development. Also included are the analyses of implications of alternatives of food for peace programs and policies on domestic farm income, foreign trade, and economic development.

The Division directs and coordinates foreign technical and training assistance programs for specialists from foreign countries studying in the United States. It maintains liaison with other divisions of ERS and SRS, and with FAS and AID, to provide technical assistance and training services.

The Division publishes regular reports on U.S. farm exports and imports, exports under special Government programs, and international monetary financial problems. It represents the Department on interdepartmental committees on studies of trade and economic development and at bilateral and multilateral international trade conferences.

What other USDA agencies conduct research?

Research, in addition to that carried on by ARS, AMS, and ERS, is conducted by the Cooperative State Experiment Station Service, Farmer Cooperative Service, Forest Service, Soil Conservation Service, and Statistical Reporting Service. All research in the USDA is coordinated through the Office of the Administrator, ARS. Each agency conducting research is responsible for the administration and operation of its assigned portion of the total research program of the Department. (See fig. 2, p. 32.) Brief descriptions of the research activities of these agencies follow.

COOPERATIVE STATE EXPERIMENT STATION SERVICE

The Cooperative State Experiment Station Service (CSESS) was established under that name in August 1961. From 1955 to 1961 it was known as the State Experiment Stations Division, Agricultural Research Service. Before November 1955 it had been the Office of Experiment Stations, the name acquired in 1888 when it was first established following passage of the Hatch Act of 1887. This act provided for USDA participation in the nationwide program of Federal support to State experiment stations. In 1955, the Congress combined previous acts relating to Federal support of State experiment station research. This was done

through passage of the Hatch Act of 1955 (Public Law 352). Section 7 of that act spells out the Secretary of Agriculture's functions and responsibilities in this area.

The Service performs, on behalf of the Secretary of Agriculture, certain duties and responsibilities that the Congress has assigned to him. In brief, the Cooperative State Experiment Station Service is responsible for USDA partnership in the program of agricultural experiment station research. Under leadership of an Administrator, the Service has a technical staff that includes specialists trained in the various fields of scientific work carried on by scientists at the individual stations. The Service is responsible for determining whether the Federal-grant funds allocated to each station are used in accordance with statutory authorization and for coordinating grant-fund projects of each State with related research of other States and the USDA. It also takes an active part in planning the cooperative regional research carried on by groups of stations, very often in close cooperation with the USDA.

FARMER COOPERATIVE SERVICE

The Farmer Cooperative Service (FCS) conducts research as a basic part of its program for helping farmers improve their economic position through soundly organized and effectively operated cooperative associations.

In conducting its activities, the Farmer Cooperative Service works jointly wherever possible with land-grant colleges and other educational institutions, State departments of agriculture, extension services, State cooperative councils, and cooperative associations.

Under authorizations in the Cooperative Marketing Act of 1926, the FCS carries on research, advisory service, and educational activities to assist agricultural cooperatives engaged in marketing farm products, purchasing farm supplies, and supplying business services essential to farmers in conducting their farming operations.

The work conducted by FCS is directed toward helping cooperative organizations solve their problems through the development and use of essential factual information. It is also directed toward bringing about a better understanding of sound cooperative principles and practices on the part of members, boards of directors, employees, and others interested in agricultural cooperatives.

Studies of cooperative business enterprises

cover such matters as organizational procedure and structure, management policies, employee relations, merchandising, accounting, operating costs and efficiency, financing, and membership.

The Service publishes the results of its research and studies in bulletins, circulars, and reports. It publishes current information and research results of interest to farmer cooperatives in the monthly magazine *News for Farmer Cooperatives*.

FOREST SERVICE

The Forest Service (FS), in its 10 regional forest and range experiment stations, in the Forest Products Laboratory at Madison, Wis., and at the Institute of Tropical Forestry in Puerto Rico, does research covering most aspects of major problems of forests and associated rangelands. A Deputy Chief of the Forest Service directs several research divisions concerned with forest and range management, forest protection, forest products and engineering, and forest resource economics and marketing.

The **Forest and Range Management Research** deals with problems of development and management of the five basic renewable natural resources of forests and ranges. These are timber, soil and water, forage, wildlife and fish habitat, and recreation. Timber management research relates to the genetic improvement of forest trees and intensive methods of timber culture and soil improvement, involving some 130 commercially important tree species. It also seeks to improve forest measurement methods, including finding new ways to speed forest inventories and to determine allowable cut and sustained yield; and to benefit the production of nontimber crops such as naval stores, maple sap, Christmas trees, and other minor forest products.

The soil and water research develops forest and rangeland practices that will protect the soil mantle and improve the yield and regular flow of high-quality water.

The forage research concerns mainly the management of forest and associated rangelands in the West and in the South and is aimed at improved grazing for domestic livestock.

Wildlife and fish habitat research deals with problems of managing forests and ranges to provide needed food and cover for various big game and other wild animals and to improve the habitat and food supply of game fish.

Forest recreation research seeks to determine the recreational requirements of the forest-using public and how best to meet them. It concerns proper management of campgrounds and other forest areas for optimum public use and enjoyment with minimum impairment of the forest environment.

The **Forest Protection Research** serves to increase the flow of goods and services from forests by reducing the ravages of fire, insects, and diseases. Forest fire research is conducted mainly at three laboratories in the Pacific Southwest, Intermountain, and Southeastern regional stations. Its scope extends from complex problems of cloud modification to reduce lightning-caused forest fires to new firefighting methods such as frontal attack with both aerial and ground forces on fast-moving blowup fires.

Forest insect research includes studies on parasites, predators, and diseases of insects; development of techniques for using these biological agents in natural environments; studies to develop safer, more effective chemicals for direct control, with emphasis on systemics for such pests as the bark beetle vector of Dutch elm disease; and development of control measures for termites and other wood-damaging insects.

Forest disease research is concerned with identifying the damaging pathogens and studying their life processes, and with developing measures for controlling tree diseases. It studies the toxic components in industrial fumes and how they affect normal tree growth and health, with emphasis on the effects of prolonged, intermittent exposure to air pollutants at low concentrations. It also makes studies aimed at improved measures to prevent the intercontinental spread of dangerous forest pathogens.

The **Forest Products and Engineering Research** relates to problems of wood utilization and of forest engineering.

Forest products research seeks to develop new and improved uses for wood. Included are wood quality studies involving the effects of environment on timber growth and the development of quality grades for logs and trees. Other studies cover problems of conversion of logs to lumber and other wood products, wood engineering for structures, improving the processing of solid wood products, proper design relative to mechanical properties of wood or wood-fiber products

used in packaging and other applications, pulp and paper processing, and production of industrial chemicals from wood.

Forest engineering research is done at seven laboratories in regional stations of the Forest Service; field research on wood utilization is done in each station. Forest engineering research aims to improve mechanization for production, harvesting, and handling of timber and related tree crops such as naval stores, with special attention to new logging equipment and systems of transport adapted to protecting watershed values.

The **Forest Resource Economics and Marketing Research** performs three major functions. The Forest Survey provides basic statistics on forest land and on quantity and quality of the growing timber through periodic inventory of the Nation's forests. Forest economics research reports on forest taxation and credit studies, evaluates the different single or combined uses of forest land, and guides public and private forestry programs through economic analysis of forest production and management practices. Forest products marketing research deals with problems of profitable markets for timber growers and suitable wood raw materials for industries. Long-range timber requirements are also studied in relation to the capacity of the Nation's forests to supply them.

SOIL CONSERVATION SERVICE

The Soil Conservation Service is responsible for the Soil Survey of the U.S. Department of Agriculture, which is carried on in cooperation with the State agricultural experiment stations. Many soil surveys are also cooperative with other State, Federal, and local agencies. The whole program is known as the National Cooperative Soil Survey.

The Soil Survey is both a research undertaking to learn the nature, behavior, and character of the soils of the United States, and an operational tool for the Soil Conservation Service and its cooperating agencies. Basic research on soils is needed for a sound soil classification system that will be useful in solving current problems of farmers, ranchers, foresters, engineers, and others.

One of the first objectives of the soil survey is to name uniformly the many different kinds of soils, so that the same kind of soil is given the same name everywhere. This makes it possible to assemble and classify the results of research and the experience of users by the different kinds

of soils. Thus the soil map, by showing the named kinds of soils, serves as a tool that helps us apply the results of research and experience selectively to individual tracts of land.

A soil survey consists of: (1) Studying and describing the kinds of soil found in the field; (2) classifying and naming them in a nationwide system; (3) locating and plotting the boundaries of the kinds of soil on detailed aerial photographs or maps; (4) studying samples of soils in the laboratory to determine their properties, especially those that influence predictions about their response to management; (5) making interpretations of soils shown on the maps, such as predictions of yields of adapted crops and groupings according to their capability for crops, woodland suitability, range potential, and so on; and (6) making interpretations of the engineering properties of soils. Soil maps with explanatory text are published to disseminate this information.

In addition to the Soil Survey, the Soil Conservation Service conducts basic soil research to increase understanding of soils and to develop new principles for guiding soil classification and interpretation. Examples include: (1) Studies of landscape evolution and soil genesis in arid areas that furnish data on the nature of the soils and the erosion processes in these areas; (2) relations between soil moisture movement and horizons of clay accumulation; (3) gullyng; (4) soil-plant relations on rangeland; and (5) relation of cobalt deficiency and molybdenum toxicity to the kinds of soil.

As of June 30, 1961, over 700 million acres in the United States—nearly 37 percent of the land area of the 48 contiguous States—had been mapped, and soil surveys of 1,816 areas, mostly counties, had been published.

STATISTICAL REPORTING SERVICE

The Statistical Reporting Service (SRS) is responsible for the collection of current statistics for agriculture and is also concerned with the review, coordination, and improvement of statistics generally in the Department.

The **Standards and Research Division** seeks to improve statistical methods and techniques methods. Proposed plans for collecting statistical methods and techniques, and development of new methods. Proposed plans for collecting statistical data are analyzed for acceptable standards, good design, and duplication of existing data. A con-

tinuing research program is conducted by the Division to improve the quality and timeliness of the statistics collected by SRS.

This Division also analyzes systems, does programming, and processes data by electronic and electromechanical equipment. It provides data processing and technical consulting services on statistical methods and techniques for other USDA agencies.

Research surveys are conducted on preferences, attitudes, motivations, and other factors affecting purchase and use of agricultural products as they relate to household, industrial, and institutional consumers and producers, and handlers and processors. In addition, special surveys are undertaken to ascertain extent of recognition, by taste or by sight, of different quality characteristics of products and to ascertain reactions to farm and market programs and services.

The **Agricultural Estimates Division**, working with and through the **Field Operations Division**, prepares and issues—as provided by law and Department regulations—the official State and national estimates and periodic reports of the Department regarding production, supply, prices, and other aspects of the agricultural economy. Included are estimates and reports of prices received by farmers for products sold and prices paid by farmers for commodities and services. From these figures, indexes of prices received and prices paid are prepared and parity prices are computed.

Estimates are developed from data supplied by thousands of crop and livestock reporters and businessmen, and from data collected in enumerative and objective measurement surveys. Forty-three State offices, covering all 50 States, collect, summarize, and evaluate monthly, annual, and other periodic and special estimates, forecasts, and reports on various aspects of the agricultural economy. Four main commodity branches—Livestock and Poultry, Dairy, Field Crop, Fruit and Vegetable—carry out estimating and reporting programs in their respective areas. The Agricultural Price Statistics Branch carries out the reporting program for prices and farm labor and wages.

Statistics supplied by SRS provide much of the data used for economic research in the Department. Likewise, estimates and reports constitute a current, stable source of economic statistics on agriculture and agricultural products for the Ex-

tension Service, for legislative and administrative officials, and for the general public.

How is agricultural information disseminated?

OFFICE OF INFORMATION

The USDA's Office of Information coordinates within the USDA the dissemination of information useful to agriculture and controls work falling into three groups: *Publications*, which includes policy review, printing, and distribution of publications; *current information*, which includes press, radio, and television materials; and *visual*, which includes exhibits, photographs, graphics, and motion pictures, as follows:

Publications.—The Publications Division is responsible for policy clearance and control of all publications of the USDA, both printed and processed, and for coordinating publications research. Through several series of technical and popular publications, information concerning results of research, conservation, regulatory, and service work of the USDA is made available to farmers and the general public. Popular publications may be obtained through Members of Congress or county agents of the Extension Service, or directly from the USDA in Washington. A *Yearbook of Agriculture* is made available annually to Members of Congress, pursuant to law, and is available generally by purchase from the Superintendent of Documents, Government Printing Office, Washington 25, D.C. An annual volume of *Agricultural Statistics* is also available through the Superintendent of Documents.

Current Information.—Current agricultural information is disseminated by the Press Service, the Radio and Television Service, and the Special Reports Division. Close cooperation is maintained with the daily, farm, and periodical press in disseminating useful information concerning USDA programs to help farmers reduce production costs, conserve the soil, improve the quality of their products, and widen their markets. Regular cooperation in assembling and broadcasting timely information to farm families is also maintained with three major radio networks. Special information is sent weekly to more than 700 radio stations for use of farm directors in program planning. In television, weekly packets reporting on research and action programs and containing suggested script and materials for ready use and

adaptation for local delivery go to more than 100 farm telecasters who request this service.

Visual Information.—Visual agricultural information is disseminated through the media of motion pictures, exhibits, illustrations, and photographs. The Motion Picture Service produces and distributes educational motion pictures designed to guide and instruct in the production and disposition of food, fiber, and oil crops. Through production and display of educational exhibits and through correlation of exhibit activities of the USDA, the Exhibits Service places before farmers, homemakers, and the general public, information on currently important agricultural situations and subjects, and especially the results of research. Illustrations and photographic production work of the USDA, with the exception of cartographic work, is performed by the Office of Information. A central file of news and general illustration photographs is maintained.

NATIONAL AGRICULTURAL LIBRARY

The dissemination of research findings of the USDA to the general public is important; but the dissemination of research findings from all over the world to scientists is also important, since it enables them to avoid duplication of research already completed. The National Agricultural Library is a basic unit in the research work of the Department. Its services are used by Department scientists, agricultural colleges and universities in the United States and abroad, private industry research firms and organizations, individual farmers, and the public.

The Library contains 1,200,000 volumes. It is one of the largest agricultural research collections in existence. Publications are acquired from more than 50 countries on subjects ranging from apiculture to zootomy. Reference, lending, and photocopying services are available not only to the USDA staff, but also to all others interested in agriculture and the related sciences.

The *Bibliography of Agriculture*, issued monthly, is a comprehensive index to world literature in agriculture and related sciences received by the Library, and may be consulted at all USDA and land-grant institution libraries. The *Index to the Literature of American Economic Entomology* is published in annual volumes and serves as a basic reference tool for entomologists everywhere. The Beekeeping Bibliography is an annotated card

file consisting of more than 80,000 selected references to the world's literature on apiculture.

The main Library, including the Law Branch, is located in Washington, D.C. It provides service to Washington employees and to field employees not served by field libraries. The Bee Culture Branch and the Beltsville Branch are located at the Agricultural Research Center at Beltsville, Md., and serve the Center employees. Agency field libraries are located at Albany and Berkeley, Calif.; Ames, Iowa; Atlanta, Ga.; Madison, Wis.; New Orleans, La. (2); Peoria, Ill.; Plum Island, N.Y.; Portland, Oreg.; and Upper Darby and Wyndmoor, Pa.

FEDERAL EXTENSION SERVICE

The Federal Extension Service provides the leadership for all general educational programs of the Department. The departmental office is composed of administrative and professional personnel who serve as the liaison between departmental research and action agencies and the administrative and extension subject-matter staffs at the respective land-grant colleges.

What is the cooperative Extension Service?

The cooperative Extension Service is the educational arm of the U.S. Department of Agriculture and the State land-grant colleges charged with conducting off-campus education in subjects relating to agriculture and home economics. This national cooperative educational system was established by the Smith-Lever Act of May 8, 1914, “. . . to diffuse among the people of the United States useful and practical information on subjects relating to agriculture and home economics, and to encourage the application of the same . . . to persons not attending or resident in said colleges in the several communities . . .”

The cooperative Extension Service is composed of the Federal Extension Service and the extension services in the 50 States and in Puerto Rico. The State extension services are an integral part of the State land-grant colleges. The work is financed and carried out through a three-way partnership among local people, the State land-grant college, and the U.S. Department of Agriculture.

At the local level, county extension workers take the lead in organizing educational programs

in which farm families, extension workers, and other leaders cooperatively incorporate local experience, scientific information, and Government program aids into county extension programs. In all this work, extension agents and specialists work closely with other agricultural agencies and with farm and civic organizations in helping people identify and solve their marketing, farm, home, and community problems.

How do American farmers receive and apply research results so quickly?

The basic job of the cooperative Extension Service is to help people analyze their situations and to make use of research findings and practical experience in developing solutions to their problems. In doing this, county and State extension workers draw upon the vast resources of knowledge developed by governmental and private research agencies.

By working closely with Department of Agriculture and land-grant college research staffs, Federal Extension Service specialists keep abreast of national research developments. They share this knowledge with extension specialists of the individual State extension services and assist them in incorporating this information into their educational programs. State specialists, in turn, work closely with the research staffs of their own colleges and are responsible for keeping county extension workers well informed on research developments and their application to the solution of individual problems.

County extension agents use many methods for helping people apply the results of research to their problems. These include demonstrations, farm tours, working with individual or small groups of families, group meetings, newspaper articles, radio and television broadcasts, and the use of localized publications prepared by the land-grant colleges and the Department of Agriculture.

The flow of research is not a one-way proposition. In analyzing local situations, farm people, county extension workers, and other agricultural leaders often uncover problems for which new research is needed before a solution can be reached.

Personally conducted tours through the USDA's many field stations, the State experiment stations, and the Agricultural Research Center at Beltsville, Md., provide a valuable method for releasing research results. Each year these establish-

ments are visited by many farmers, processors, marketing people, research workers, and others to observe at firsthand the accomplishments being achieved through research. There are several pilot research farms where new techniques are tested within a complete farming system and modified as the need is shown. Farmers attend demonstrations at these farms and see findings of research applied on land of the same general type as their own. The interest of American farmers in observing and using the developments of agricultural research is largely responsible for the rapidity with which results are adopted. In fact, progressive farmers are often eager to put the findings into practice even before the authorities are ready to recommend them.

The findings of research, in many cases, are carried by farm and commodity organization field staff members to their clients through individual contact and publications. Many commercial organizations sell their products to farmers in the same way. In other words, many people help communicate to the public the findings of research. While it is recognized that communication by mass media is a good way to get the information to a great number of people, it does not necessarily guarantee that individuals make use of the findings just because they are communicated. Extension workers are finding, too, that the best motivation for the use of research findings is the individual teaching approach; that is, individual contact with farmers by county agricultural workers.

How do commerce and industry benefit from agricultural research? How does the consumer benefit?

Results of agricultural research of interest and use to commerce and industry are published in the trade papers and magazines. Trade groups keep in touch with this work through commodity advisory groups and the National Agricultural Research Advisory Committee. At each of ARS's regional Utilization Research and Development Divisions, where the work is of direct interest to industry, a technically trained official is designated as liaison between the Division and industry. USDA representatives often attend meetings of industrial associations and discuss research results that pertain to their particular fields of interest. Publications aimed specifically at help-

ing the trade are made available by the USDA. Frequently, when a research project has been completed and tested in a pilot plant, representatives of industrial groups are invited to see the operation and to discuss the possibilities of commercial adaptation.

Consumers benefit either directly or indirectly from all agricultural research, since it deals with food, clothing, and shelter. For example, marketing research is conducted to find out how to get agricultural food crops from farms to consumers in the best possible condition, both in nutritive value and appearance, and at a reasonable cost. Research in nutrition and home economics is also of direct concern to consumers, as is research on household insects, meat, dairy and poultry products, and rural housing and household equipment. Both urban and rural consumers become acquainted with research that benefits them in many ways. They read about it in city and farm papers and magazines, see or hear about it on television or radio, see new products in the stores with identifying display advertising, and receive publications issued by the USDA and the State experiment stations.

Are agricultural research findings made available to foreign countries? If so, how?

Since the inception of the program for foreign technical cooperation, which is now administered by the Agency for International Development (AID) of the Department of State, the USDA has cooperated fully in making research information available to U.S. AID missions in three ways: (1) By training foreign nationals on an inservice basis in Federal laboratories, offices, and field stations, or by assisting in the development of study programs at institutions of learning; (2) by providing technical information and consulting services in response to requests from the oversea U.S. AID missions; and (3) by special projects contracted between AID and a subject-matter agency of the USDA. For example, ARS has special projects in Regional Insect Control (in the Middle East and Africa), Seed and Plant Materials (interchange of plant materials), and Technical Services on Salinity and Soil Fertility.

This type of technical cooperation was first concentrated in Latin America in 1941 on the tropical and semitropical products that are grown there

and imported in large quantities by the United States. The program has been extended in recent years to an increasing number of countries in Europe, Africa, the Middle East, and the Far East. The USDA also has representatives in the U.S. delegations to conferences of the Food and Agriculture Organization of the United Nations, where many technical agricultural problems are discussed.

Another important way in which research information reaches other countries is through foreign agricultural administrators, scientists, and students who visit the experimental laboratories and field stations in the United States. The USDA is helping to impart information in the field of agriculture to these visiting foreign nationals. The number of representatives from foreign countries who visited the Agricultural Research Center during the past 11 years is as follows:

Fiscal year:	<i>Number of visitors</i>
1952-----	2, 278
1953-----	2, 321
1954-----	1, 527
1955-----	1, 552
1956-----	1, 747
1957-----	2, 491
1958-----	2, 122
1959-----	2, 460
1960-----	3, 374
1961-----	2, 805
1962-----	2, 196

From July 1960 through June 1961, the 2,805 foreign visitors represented 105 different nations. From July 1961 through June 1962, the 2,196 foreign visitors represented 110 nations. These same foreign visitors also traveled to many Federal and State field stations and land-grant institutions throughout the United States in order to obtain information concerning agricultural research, production, marketing, extension, and resident education.

An outstanding effort to assist in this endeavor is being made by the National Agricultural Library. Published results of research are available not only to American farmers, consumers, and the trade, but also to individuals and institutions of other countries. Although individuals must purchase publications for their personal use, institutions (particularly libraries) may often obtain them through the exchange programs maintained by the Department Library. Under these programs, the Library sends the USDA's scien-

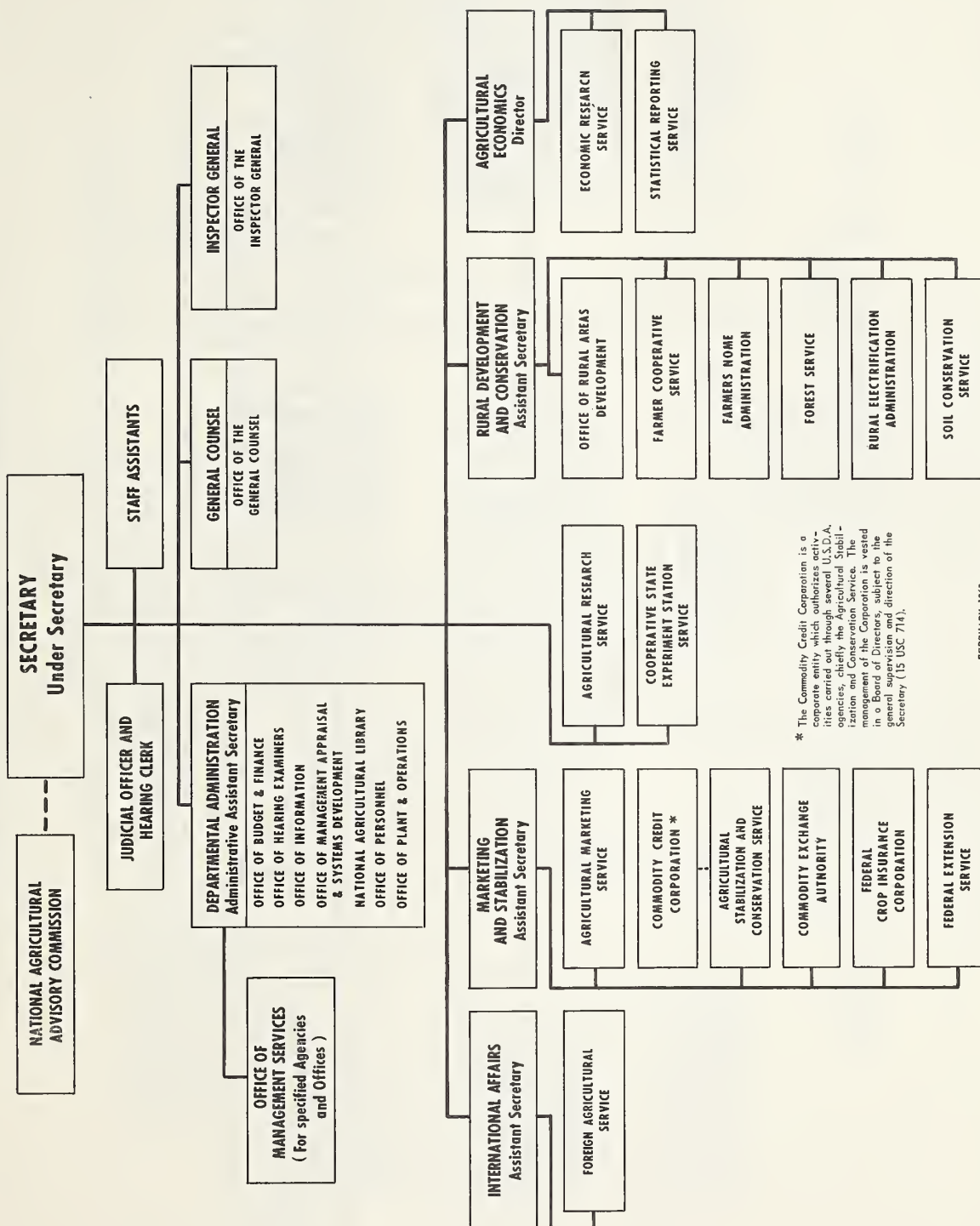
tific and technical publications in exchange for similar publications of other countries. The Library has exchange arrangements with between 4,000 and 5,000 institutions in 200 countries, which means that the publications they receive are available on loan or for reference in their libraries. Publications received from other countries are likewise available in the National Agricultural Library for the use of USDA's research staff and other interested persons. Notification of their availability is made through listing them in the Library's monthly *Bibliography of Agriculture*.

The Publications Exchange Information Center in the Library aids the land-grant colleges and State universities in establishing exchanges and in selecting foreign libraries to serve as repositories for their agricultural publications. The U.S. Department of State and the U.S. Informa-

tion Agency also aid in the exchange of information. There are currently 177 information centers and 78 reading rooms in 82 foreign countries. These centers maintain libraries, and publications are freely available to all persons who wish to obtain current information about the United States.

There is also a vast amount of private and semi-private assistance in the dissemination of research information. Farm magazines and scientific journals of agriculture published in the United States are circulated throughout the world. Some of our State colleges and other educational institutions cooperate with foreign institutions on specific projects. Numerous international organizations in specific fields of science offer international forums for the exchange of scientific information.

UNITED STATES DEPARTMENT OF AGRICULTURE

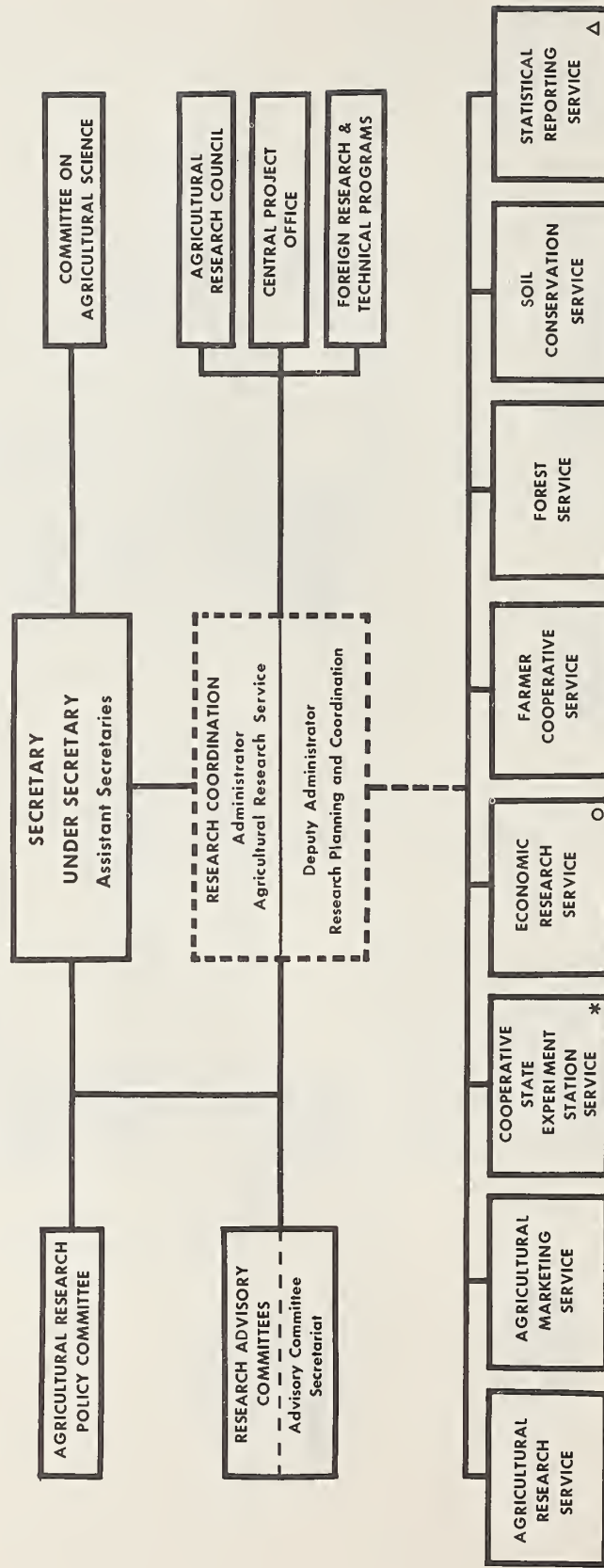


* The Commodity Credit Corporation is a corporation which conducts activities authorized by the Agricultural Stabilization and Conservation Service, subject to the general supervision and direction of the Secretary (15 USC 714).

FEBRUARY 1963

FIGURE 1.—Organization of the United States Department of Agriculture.

ORGANIZATION FOR RESEARCH COORDINATION AND PROGRAM DEVELOPMENT IN THE USDA

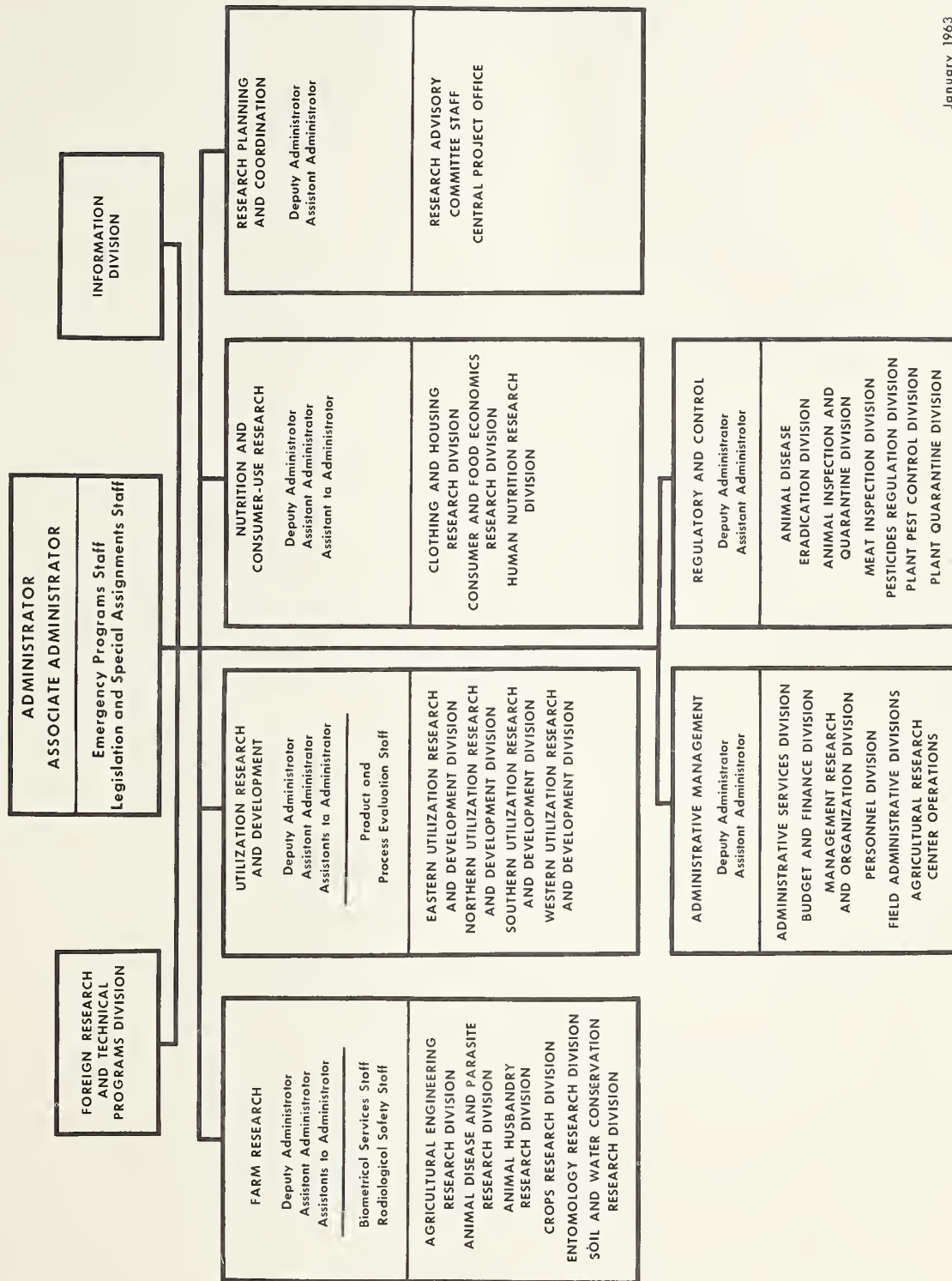


* DIRECTS AND COORDINATES ADMINISTRATION OF ALL PROGRAMS AND ACTIVITIES PERTAINING TO THE STATE EXPERIMENT STATIONS
O COORDINATES ECONOMIC ANALYSIS WORK OF THE DEPARTMENT
Δ REVIEWS, CLEARS, AND COORDINATES STATISTICAL WORK OF THE DEPARTMENT

FIGURE 2.—Organization for Research Coordination and Program Development in the USDA.

January 1963

UNITED STATES DEPARTMENT OF AGRICULTURE AGRICULTURAL RESEARCH SERVICE



January 1963

Figure 3.—Organization of Agricultural Research Service.



